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THE CANADIAN NAVY'S INFLUENCE ON FUTURE AIR FORCE ROLES

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Armed forces are a product of the environment from which they come and the environment in which they are expected to be employed. As the Canadian Forces (CF) adjust to the new post Cold War peacetime environment; they must overcome the legacy of previous defense policy and equipment acquisition choices. Given the latest direction in Canadian Defence Policy, one area yet to be resolved is the inability of the air force and the navy to fully operate in the anticipated environment. The current environment of the CF, as-well-as the anticipated environment of employment detailed in the latest defense policy, is presented. It is then demonstrated that the flexibility, endurance, and efficiency of naval forces uniquely establishes them as ideally suited for early commitment to a crisis in an effort to influence or stabilize the situation before open hostilities erupt. As was the case with Canada?s naval Task Group during the Arabian Gulf War, due to their unique characteristics; naval forces are usually the first committed during a crisis. Therefore, given a defense policy requirement to operate together; future roles of Canada?s air force will be influenced by and linked to the navy. By tracing the development of the naval and air forces in Canada; it can be seen that previous acquisition choices have produced two forces not fully suited for the anticipated environment of employment. The air force lacks an effective independent standoff surface attack capability, particularly the ability to provide effective anti-surface warfare support to the navy. Further, the modern Canadian surface fleet does not have the ability to conduct the emerging primary role of naval forces which is power projection ashore. In the small, professional, unified armed forces of Canada which are under tremendous budgetary constraints due to the national debt, any solution to these two significant deficiencies must be relatively inexpensive and maximize benefits. Although there are likely numerous courses of action possible; one course of action is presented in this paper which is believed to satisfy the present fiscal environment, is realistic, and resolves the current areas of concern. The primary purpose for presenting a course of action for consideration is to demonstrate that although the concerns are considered significant; they are relatively easily resolved through comparatively inexpensive acquisition, platform modification, and training.

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Preface

As the Canadian Forces (CF) adjust to the challenges of the post Cold War era, it is important that a focus on combat capabilities not be lost. As we adapt to the realities of the new defense environment, synergy between all portions of the CF is essential in order to maximize effectiveness and efficiency. One aspect which I believe needs greater attention is the air force's inability to conduct an effective standoff surface attack in today's modern, high threat littoral environment, particularly as it applies to supporting ships at sea. While conducting research on this matter, one unexpected revelation was the inability of the modern Canadian naval forces to conduct power projection ashore. Power projection ashore is rapidly developing into the primary role of the world's navies.

Notwithstanding, the purpose of the research was to call attention to an aspect of force development which I have long considered important; the need for improved synergy between Canadian air and naval forces. This paper calls attention to specific concerns and provides one course of action for consideration which will resolve it. Granted, the course of action presented is not overly exhaustive or rigorous; however, it demonstrates that the concerns, although significant, can be relatively easily resolved through focused effort.

Finally, I wish to acknowledge the support and encouragement of my wife Linda Gray, without whom this paper could not have been written.

Abstract

Armed forces are a product of the environment from which they come and the environment in which they are expected to be employed. As the Canadian Forces (CF) adjust to the new post Cold War peacetime environment; they must overcome the legacy of previous defense policy and equipment acquisition choices. Given the latest direction in Canadian Defence Policy, one area yet to be resolved is the inability of the air force and the navy to fully operate in the anticipated environment.

The current environment of the CF, as-well-as the anticipated environment of employment detailed in the latest defense policy, is presented. It is then demonstrated that the flexibility, endurance, and efficiency of naval forces uniquely establishes them as ideally suited for early commitment to a crisis in an effort to influence or stabilize the situation before open hostilities erupt. As was the case with Canada's naval Task Group during the Arabian Gulf War, due to their unique characteristics; naval forces are usually the first committed during a crisis. Therefore, given a defense policy requirement to operate together; future roles of Canada's air force will be influenced by and linked to the navy.

By tracing the development of the naval and air forces in Canada; it can be seen that previous acquisition choices have produced two forces not fully suited for the anticipated environment of employment. The air force lacks an effective independent standoff surface attack capability, particularly the ability to provide effective anti-surface warfare support to the navy. Further, the modern Canadian surface fleet does not have the ability to

conduct the emerging primary role of naval forces which is power projection ashore. In the small, professional, unified armed forces of Canada which are under tremendous budgetary constraints due to the national debt, any solution to these two significant deficiencies must be relatively inexpensive and maximize benefits. Although there are likely numerous courses of action possible; one course of action is presented in this paper which is believed to satisfy the present fiscal environment, is realistic, and resolves the current areas of concern. The primary purpose for presenting a course of action for consideration is to demonstrate that although the concerns are considered significant; they are relatively easily resolved through comparatively inexpensive acquisition, platform modification, and training.

Chapter 1

The Canadian Defense Reality During Peace

As witnessed during the Boer War, both World Wars, and the Korean War; Canadians have a time honored tradition of gallant wartime performance and commitment. "In 1945 Canadian land, sea, and air forces were the third most important amongst the Western allies."[1] However, with the rapid demobilization which followed; the Canadian military has been reduced to a peacetime shadow of its former stature. As a relatively young nation with a small population, Canada historically pursues national development interests during times of peace, i.e. the absence of war, rather than maintenance of large military forces built up during conflict and war. The historical trend remains applicable today. Canada's 29 million inhabitants are proud that their nation is a long-standing member of the Group of Seven (G-7) states; "the seven most economically developed countries"[2] in the world. The G-7 includes "the United States, Great Britain, France, . . . Germany, Italy, Canada, and Japan . . ."[3]; countries which have conducted ". . . regularly scheduled economic summit meetings since 1975."[4] Notwithstanding Canada's economic ranking, defense spending traditionally ranks fourteenth in the western world.[5]

Notes

[1]David C. Isby and Charles Kamps Jr., *Armies Of NATO's Central Front* (Somerset: Butler and Tanner, 1985), 79

Notes

[2]Helen E. Purkitt, *World Politics 96/97* (Guilford, Connecticut: Dushkin Publishing Group/Brown & Benchmark Publishers, 1996), Glossary

[3]Barry B Hughes, *Continuity And Change In World Politics* (New Jersey: Prentice Hall, 1994), 33.

[4]Ibid.

[5]Jane's Information Group, *Jane's NATO Handbook 1991-92* (Surrey: Jane's Information Group Limited, 1991), 422

Chapter 2

The Navy

The Navy Since WW II

A founding member of the North Atlantic Treaty Organization (NATO), through the intervening years since World War (WW) II, Canada has pursued its defense interests through international collective security arrangements. In spite of its relatively small peacetime size which is to be reduced to a Regular Force strength of 66,700 by 1998[1]; the Canadian Forces continually strive to make a significant and vital contribution to international defense commitments. Take the navy for instance. During the era following WW II, the Canadian navy focused primarily on the Anti-Submarine Warfare (ASW) escort role, a natural extension of the capability and expertise developed during WW II. This role was considered vital in any post WW II military conflict because of the requirement to maintain the trans-Atlantic link between North America and Western Europe in the face of a massive Soviet submarine force. During any East-West hostilities, Canadian ASW escorts would have primarily contributed to the escort screen assigned to larger NATO forces, e.g. task or carrier battle groups.

Greatly preoccupied with enforcing national sovereignty, during the mid-1980's Canada committed to the construction of a general purpose naval force capable of

conducting not only ASW, but also Anti-Surface Warfare (ASuW), and Anti-Air Warfare (AAW). This approach would not only enhance the naval capabilities of the nation with the longest coastline in the world, but signaled a change in Canada's intended contribution to international security. During a crisis, rather than simply making a piecemeal contribution to task or battle groups through the provision of ASW escort assets, a dedicated Canadian Task Group would be assigned. As a result a more identifiable Canadian contribution could be made. In preparation, the navy began to plan, organize and train along the lines of a naval task group. This effort became useful during the Arabian Gulf War where it was "…agreed that the Canadian contribution to the effort against Iraq should be a clearly identifiable Canadian one. The choice was being split up and operate screening the carriers in the central-northern Gulf, under another nation's task group, or remain together and take on a significant task group responsibility."[2] In remaining together, the Canadian Task Group commander was assigned the duties of Combat Logistics Co-ordinator. Of the three major naval commands in the Gulf, the Canadian command was the "…only major naval responsibility during the war not commanded by the USN."[3]

In the early to mid-1990s the results of the construction program produced a modern naval fleet capable of operations in a high threat environment. Twelve state of the art general purpose Canadian Patrol Frigates were constructed and the four Tribal Class destroyers were modernized and provided with an area AAW capability. The Auxiliary Oiler Replenishment ships were simultaneously provided enhanced command, control, and communication equipment and self defense provisions. Appendix A, entitled Large

Combatants Of The Canadian Navy, provides a detailed description of these ships and their capabilities.

The newly established task group capability remains relevant in the post Cold War environment. Among other things, the latest "Defence White Paper", which documents defense policy, recommended that Canada should maintain "a naval expeditionary capability, i.e. to deploy one task group (up to 3 frigates, one destroyer, one operational support ship) and sustain that force indefinitely, and to deploy maritime patrol aircraft and, if available, submarines…"[4] anywhere in the world.

Speculation About Future Naval Development

As the new Canadian naval capability emerged, the next developmental step was obvious and became the subject of discussion in defense related circles - ships with among other characteristics, an enhanced air capability. Publications such as *Canadian Defence Quarterly* contained discussions regarding the "acquisition of a vessel along the lines of MIL's (MIL System Engineering Inc.) proposed Multi-Role Aid and Support Ship. A . . . vessel with replenishment-at-sea gear, the ability to transport personnel and heavy equipment, a substantial helicopter capacity and a host of other attributes."[5]

Source: Martin Shadwick, "Focus On Peacekeeping Equipment," *Canadian Defence Quarterly*, Volume 22, No. 2 (Autumn 1992): S4

Figure 1. The Proposed Multi-Role Aid And Support Ship

The United States Naval Institute *Proceedings* contained an article which went further. It recognized the new Canadian ships as "armed and equipped to modern war-fighting—not peacekeeping—standards,"[6] but stated that "true commitment to multilateralism and solidarity would have Europe and Canada building a composite fleet for NATO use…"[7] and proposed consideration be given to building "…an adequate NATO carrier/amphibious force with supporting sealift and service vessels."[8]

Operationally, consideration of ships along the line of the ones proposed in *Proceedings*, particularly an aircraft carrier, is quite exciting for a military which has not conducted carrier operations since 1970.[9] Aircraft carriers, for example, are an extraordinarily formidable force projector in the maritime arena because they have the ability to project air power in the AS, ASu and AA Warfare areas. The range and speed of carrier based aircraft combined with their weapons capability enable a naval task group to significantly increase its surface footprint reach in all three of the aforementioned warfare areas while in open ocean. Additionally, in littoral areas the carrier has the flexibility of projecting its air power over land in the conduct of AAW and attack operations. Finally, modern aircraft carrier operations have the potential to be much more

efficient and flexible through the use of multi-mission aircraft like the F/A-18 which can effectively conduct AAW, ASuW, and attack operations.

An aircraft carrier would greatly enhance the capabilities of the Canadian Task Group because in reality there are very few states which possess this capability. Therefore, construction of an aircraft carrier would thus catapult any state with such a vessel near the top of the international naval order. The United States of America (USA), and France possess a "fixed wing" aircraft carrier capability and Russia is developing one. Other states such as the United Kingdom, Italy, Spain, Thailand, etc. possess the less capable "jump jet" carriers employing Harriers. Finally there are those with helicopter carriers and assault ships.

Although the acquisition of an aircraft carrier would be significant from a military force projection capability, realistically it is unlikely that the proposal made in *Proceedings* would be pursued in the reality of the present Canadian peacetime defense climate. The prime consideration of the government, quite rightly given the present post Cold War international environment, is to balance the federal budget which it expects to accomplish in one and a half years. It is unlikely that additional funds would be made available for a new project of this magnitude. Since all current defense expenditures are required to either replace aging systems presently in the inventory, or upgrade them to maintain their effectiveness; creative budgeting associated with present projects in order to secure funding to finance a project the magnitude of a large capital ship is not a realistic option. In fact, the current defense policy recognizes that it will likely not even be fiscally possible to maintain all of the present capabilities. For example, despite recognizing the fact that "from a military point of view, there is no doubt that submarines represent a uniquely

effective, and comparatively inexpensive, weapons platform…there is simply not a case to be made for embarking on a conventional capital replacement program for the current…" submarines.[10] "The Canadian treasury simply cannot bear such an expense even if it were phased over ten or more years…(unless it) could be managed within the existing capital budget."[11] The anticipated cost of a conventional submarine capital acquisition program is $4-6 Billion.

Notes

[1]Special Joint Committee On Canada's Defence Policy, *Security In A Changing World* (Ottawa: Government Of Canada, 1994), 27

[2]Commodore Duncan (Dusty) E. Miller and Sharon Hobson, *The Persian Excursion. The Canadian Navy In The Gulf War* (Mississauga: Arthurs-Jones Lithographing Ltd., 1995), 92

[3]Ibid., 94

[4]Special Joint Committee On Canada's Defence Policy, *Security In A Changing World* (Ottawa: Government Of Canada, 1994), 39

[5]Martin Shadwick, "Focus On Peacekeeping Equipment," *Canadian Defence Quarterly*, Volume 22, No. 2 (Autumn 1992): S5

[6]Alexander Wooley, "A European Navy Far From Home," *Proceedings*, Volume 122/ /1,117 (March 1996): 54

[7]Ibid.

[8]Ibid.

[9]Jane's Yearbook, *Jane's Fighting Ships 1969-70* (New York: McGraw-Hill Book Company, 1969), 38-39

[10]Special Joint Committee On Canada's Defence Policy, *Security In A Changing World* (Ottawa: Government Of Canada, 1994), 38

[11]Ibid.

Chapter 3

Post Cold War Defense Policy Specifics

The debate regarding the next type of ship required by the navy appears to have had some affect because the defense policy "White Paper" recommended the acquisition of "multi-role support vessels."[1] Although the addition of an aircraft carrier would have significantly enhanced both the fixed and rotary wing capability of Canada's naval expeditionary task group, with the acquisition of multi-role support vessels a substantial helicopter capability will likely be gained. From a broader perspective, the "White Paper" recommended that Canada "…maintain unified, combat-capable, multipurpose armed forces, composed of sea, land, and air elements that are…able to operate together abroad in support of Canada's multilateral peace and security interests and responsibilities."[2] Specifically regarding international security interests; it recommended that Canada maintain:

1. the naval task group expeditionary capability including the ships and aircraft described above,
2. "the capability to deploy and sustain indefinitely a fighter squadron (18 aircraft),
3. the capability to deploy and sustain indefinitely, as Canada is currently doing, two battle groups with appropriate logistic, medical, communications and engineering support. These forces should also be capable of deployment as a contingency brigade group for larger or more demanding operations for a limited period of time."[3]

The "White Paper" takes a notable, yet realistic and constrained step forward in light of today's fiscal environment. The requirement for the naval, air, and army forces committed to international security interests to operate together will likely have a synergistic effect on all operations, capabilities, as-well-as future equipment modifications and acquisitions. This close teaming of expeditionary naval forces with shore based fixed wing maritime and fighter aircraft has the potential to produce a marked improvement in present capabilities. In view of the tremendous advantages that could be accrued in more fully teaming air assets with the Canadian Task Group (CTG), provision of fixed wing support from shore based facilities should be more closely considered.

Source: The Canadian Institute Of Strategic Studies, *Canadian Defence Quarterly*, Volume 22, No. 6 (Summer 1993): 49

Figure 2. One Proposal For A Multi-Role Support Vessel

Notes

[1]Special Joint Committee On Canada's Defence Policy, *Security In A Changing World* (Ottawa: Government Of Canada, 1994), 36

Notes

[2]Ibid., 33
[3]Ibid., 39

Chapter 4

Today's Naval Environment

For hundreds of years naval forces have often been the vanguard of national security interest for maritime trading nations like Canada. They have the ability to freely navigate seventy-five percent of the earth's surface and their endurance allows them to maintain a long term presence in areas of interest to demonstrate national interest, resolve, and if necessary exercise economic, political, informational, and military instruments of power. Since "75 percent of the nations of the world border on the sea and 80 percent of the world's capitals are located within 300 miles of the coast;"[1] naval power is extremely significant. "Ships and submarines can…project effective power on the land mass to attack political and industrial assets.…Even more significant from the overall political and strategic point of view, the warships' inherent ability to establish and maintain a continuous presence in a given crisis area provides a very effective way to exert political pressure, far more flexible than the 'all or nothing' option of a strike by land-based aircraft"[2] or commitment of the army. Due to the ease and efficiency with which they can be deployed during a conflict situation, their endurance and ability to project a continuous presence, naval forces are often committed prior to hostilities breaking out and generally prior to the commitment of forces from the air force or army. Canada's experience during the Kuwait Crisis supports this position; the first forces committed to the Arabian Gulf

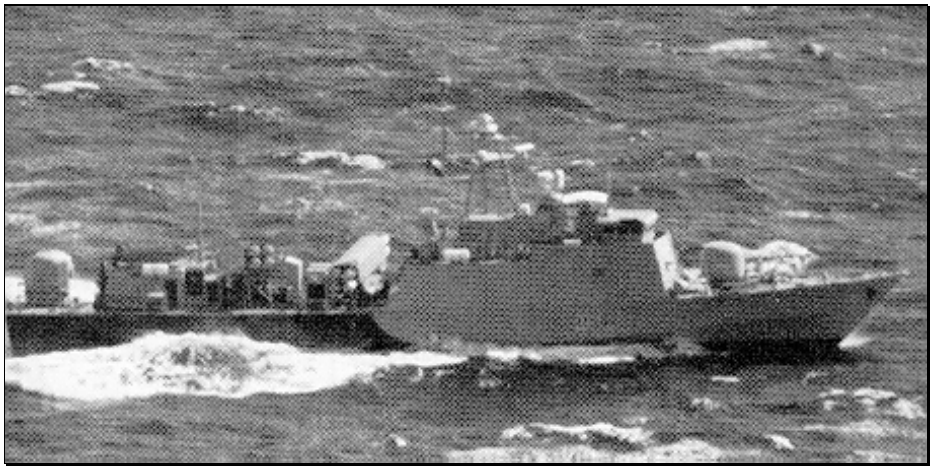
was a naval Task Group. Given the propensity for the early commitment of ships during a conflict; it is likely that the future roles of Canada's air force are inexorably linked to the navy.

Littoral Operations

The first characteristic of today's naval environment is a focus on littoral operations and subsequent power projection ashore. Areas of interest regarding the employment of naval forces range from one's own shores, mid-ocean sea lines of communication, a trading partner's shores, or the shores of a troubled region of the world. Traditional views of the roles or missions of the navy during war are to: "prevent the enemy's use of the sea; secure the use of the sea for one's own purpose; and contribute directly to the battle on land."[3] During the Cold War the focus of NATO navies was on the first two missions because of the direct challenge posed by the Soviet Navy. The addition of aircraft to ships produced a formidable capability, particularly in mid-ocean, blue water, engagements beyond the range of shore based aircraft support. The aircraft carrier represented the ultimate combination of naval and air power. However, with the demise of the Eastern Block, essentially there are no longer direct mid-ocean naval fleet challenges to NATO navies. In short, a Mahanian "blue water" fleet on fleet engagement is unlikely in the current post Cold War environment. As a result, "in the new foreseeable future operational scenarios that are emerging following the end of the Cold War…, sea control/sea denial is losing at least part of its original significance as a mission.…This is due to the generalized assumption that the 'good guys' will automatically enjoy virtually total sea control under most operational circumstances, or will anyway be able to quickly

establish it with relatively modest efforts. In parallel, power projection ashore is increasingly being seen as the navies' main mission…"[4] It is for this reason that the United States Navy (USN), the world leader in carrier operations, is focusing on littoral operations. These are operations along a "coastal region"[5] where it is expected that future conflicts will ensue. It is believed that these conflicts will be regional in nature and be conducted at a medium intensity level, much like the conflict which occurred to eject Iraq out of Kuwait.

The littoral area is extremely challenging because operations are very complex since naval, marine, army, and air forces can all influence the situation. Often large numbers of enemy fighters are within range. Enemy submarines, particularly diesel-electric boats, are difficult to prosecute in the shallow noisy coastal "brown water." Enemy patrol boats are small, fast and often armed with similar ASuW systems fitted to ones own frigates, destroyers, and cruisers. Finally, enemy ground forces ashore generally have a surface-to-air (SAM) missile capability. Aircraft, particularly fighter aircraft, present a tremendous counter balance to the broad spectrum of enemy forces likely to be present in littoral areas. Aircraft are small, fast, have considerable range, and are capable of precision weapon engagement; they are extremely effective in littoral areas.



Source: Jane's Information Group, *Jane's Fighting Ships 1996-97* (Surrey: Jane's Information Group, 1996), 483.

Figure 3. Oman's DHOFAR Class Fast Attack Craft

Standoff Ranges

The second significant characteristic of the modern naval environment is the increasing standoff ranges employed by various combatants. Increasingly ships, aircraft, and other combatants operating in the littoral areas are fitted with missiles capable of tremendous ranges. The SM 2 Standard missile is an example of a surface-to-air missile which "…is designed to destroy small fast targets (for example, anti-ship cruise missiles) as well as missile-launch platforms in hostile environments created by weather or countermeasures."[6] This missile is generally employed on dedicated AAW ships to provide area protection to other naval vessels; it has a range of "…73 kilometers (km) or 40 nautical miles (nm)."[7] Even surface-to-air missiles such as NATO Sea Sparrow that ships use for individual, or point, self-defense in the event something gets through the area protection provided by AAW ships are reported to have a range of "…14.6 km (8 nm)."[8] Similarly, the surface launched HARPOON anti-ship missile has a range of "…135 km (70 nm)."[9] The Standard, Sea Sparrow, and Harpoon missiles are relatively common; they are

employed by the Canadian navy, and represent ranges which are characteristic of the current naval environment. These considerably long missile ranges were developed for platforms operating at sea because ships and aircraft are vulnerable to long range detection resulting from the inability to use terrain etc. to mask one's presence. The nature of the detection ranges necessitate that weapons platforms have a very good standoff capability to engage targets at relatively long range.

Further, the USN vision of the Cooperative Engagement Capability (CEC) promises to lead a trend to extend the current relatively long missile ranges even further. CEC enables weapons to be launched from one platform and then be "handed-off" to another platform for final engagement on target. In this manner the fire power that any one platform, for example a ship or aircraft, can bring to bear on a target is greatly increased by missiles launched from supporting platforms. This concept will precipitate the development of increasingly long range missiles.

Limited Assets

The third and final significant characteristic of today's naval environment is the limited number of assets most nations have to commit to operations. With the number of carriers that the USN possesses; it is possible to have a forward presence within a short steam of the world's potential trouble spots. In these littoral situations, the advantage of a USN carrier group is its ability to rapidly be on station. Endurance is also a significant characteristic of a carrier group in that they can remain on station for a considerable period of time. In the case of Canada, and most states other than the USA; naval assets are not sufficient to permit a continual global projection of force. It is quite safe to say

that most other countries must wait for a crisis to develop, or show signs of developing, and then dispatch naval forces in response. Often, the deployment of naval forces to a crisis area is quite lengthy; consider the time it took the Royal Navy (RN) to steam to the Falkland Islands or the better part of a month required to steam from the East Coast of North America to the Arabian Gulf.

Notes

[1]Admiral Jay L. Johnson, USN Chief Of Naval Operations, address to the USAF Air War College and Air Command And Staff College, Maxwell Air Force Base, Al, 7 February 1997

[2]Massimo Annati and Ezio Bonsignor, "Punch From The Sea," *Military Technology*, Vol. XX (Issue 7 1996):51

[3]Geoffrey Till, *The Future Of British Sea Power* (Southampton: Camelot Press Ltd, 1984), 243

[4]Massimo Annati and Ezio Bonsignor, "Punch From The Sea," *Military Technology*, Vol. XX (Issue 7 1996):44

[5]Captain John V. Noel Jr., US Navy (Retired) and Captain Edward L. Beach, US Navy (Retired), *Naval Terms Dictionary, Third Edition* (Annapolis, Maryland: Naval Institute, 1971), 168

[6]Hubert Moineville, *Naval Warfare Today And Tomorrow* (Oxford: Basil Blackwell Publisher Limited, 1983), 75

[7]Jane's Information Group, *Jane's Fighting Ships 1994-95* (Surrey: Jane's Information Group, 1994), 788

[8]Ibid., 87

[9]Ibid.

Chapter 5

Shore Based Aircraft In Today's Naval Environment

As previously presented, aircraft are extremely effective in littoral areas. However, these aircraft do not necessarily need to originate from an aircraft carrier. The time required for naval assets to steam to a trouble spot permits the establishment of shore bases for aircraft to support the ships. Notwithstanding, squadrons operating ashore in littoral areas must possess the same capabilities as squadrons assigned to aircraft carriers; they must be able to conduct AAW, ASW, ASuW over the water and AAW and attack, including close air support (CAS) to army units, over land.

For years the Royal Air Force has operated dedicated anti-shipping fighters out of Northern Scotland to control the maritime area located between Greenland, Iceland, and the United Kingdom known as the GIUK Gap which is illustrated at Appendix B.[1] The effectiveness of shore based aircraft is demonstrated by the challenge Argentine fighters posed to the Royal Navy during the Falklands War. In his memoirs, the British Battle Group Commander, Admiral Sandy Woodward, recalls that in a six week period ". . . I lost nearly half of the destroyers and frigates I started with."[2] As presented at Appendix B; this conflict becomes notable when one considers that Port Stanley is approximately 400 miles form the Argentine coast. Even with these distances, fighter and fighter combined with refueling tanker aircraft can provide a tremendous challenge to naval

forces. The converse can also be true. Shore based aircraft can also provide tremendous support to naval forces. Due to the proximity of a potential high intensity air threat from Iraqi fighter aircraft to Canadian and other Allied ships operating in the central to northern Arabian Gulf during the Kuwait Crisis; Canadian CF-18s were deployed to provide shore based counter air cover. These aircraft, combined with tankers were easily able to maintain an effective screen while based relatively south in Dauha, Qatar, Appendix B refers. Also, the viability of the concept of shore based aircraft utilized in littoral areas to support naval assets is validated when considering that all Canadian areas of post Cold War operation, the Arabian Gulf, Somalia, Haiti, and the Adriatic Sea permitted access to adequate aircraft shore bases within the operational area or rapid construction of adequate facilities by combat engineers.

Essentially, shore based squadrons must be capable of generating the same kind of support generated by carrier based squadrons. In supporting ships at sea operating in the littoral area, shore based fighter squadrons have the added challenge of operating from fixed bases. However, this disadvantage can be mitigated through the efficient use of aircraft which is facilitated by the Airborne Early Warning And Control System (AWACS) and tanker aircraft which are always available during a crisis. AWACS and tankers have tremendous endurance and can essentially provide continuous coverage in littoral areas. Also, forward operating and dispersal locations can be effectively used to enable the flexibility needed to support ships in the littoral area. The Arabian Gulf conflict demonstrated that shore based fighter aircraft can support ships at sea.

Intuitively one thinks of the Pacific Ocean as the sole domain of the aircraft carrier. However, even in the Pacific which is characterized by very long distances, shore based

fighter aircraft could be effective. Take the current dispute surrounding the Spratly Islands as an example, Appendix B refers. In this case, shore based fighter aircraft which achieved the same ranges achieved by shore based fighter aircraft in the Falklands War or the Gulf would be effective. Granted, shore based fighters cannot be considered as efficient as the fixed wing carrier based fighter assets integral to a naval task group, however, they are nonetheless very effective. Also, shore based aircraft operating at extreme ranges with minimal AWACS and tanker support would be vulnerable to embarked enemy fighter aircraft, but given that extremely few states are aircraft carrier capable and the most that are capable are NATO members, this is not an overriding concern. In short, shore based fighter aircraft supported by AWACS and tanker aircraft can effectively support ships at sea in the high threat littoral area. Likewise, longer range fixed wing patrol aircraft such as the CP-140 Aurora conducting ASW and ASuW are designed for shore based support of operations at sea and as a result they too are effective in the littoral environment.

Notes

[1]Terence Gander, *Encyclopedia Of The Modern Royal Air Force* (Oxford: The Alden Press, 1984), 25

[2]Admiral Sandy Woodward, *One Hundred Days* (Annapolis, Maryland: Naval Institute, 1992), 348

Chapter 6

The Problem

The Canadian Defence Policy requirement for naval, air, and army forces to be capable of operating *together* essentially specifies the ability to operate in a littoral area. As presented above, littoral areas are extremely challenging high threat environments where air power can make a tremendous contribution. In littoral areas concerns are AAW, ASW, ASuW over the water and AAW and attack, including close air support (CAS) to army units, over land. At present the Canadian air force squadrons possess a good capability in AAW, ASW, and CAS. The present capabilities are in large part due to the historical employment of Canada's maritime and fighter forces specified by previous national defense policy and the subsequent equipment and armament acquisition efforts which ensued. Unfortunately, despite a recognized role/mission to provide Tactical Air Support To Maritime Operations (TASMO);[1] the ASuW and standoff attack capabilities needed in the littoral area have essentially remained undeveloped. However given the state of the art capability of the naval task group and the propensity for these to be the first military assets committed to a crisis area, the requirement to support these ships in the high threat littoral environment once hostilities have commenced will likely influence development of true air force ASuW capabilities. As presented earlier, future roles of the air force will be influenced by the navy.

Another dimension of the problem stems form the Cold War origins of the present naval fleet. Although the present fleet is recognized as having state of the art at sea fighting capabilities; its ability to project power ashore, in the mission which is increasingly seen as the primary focus for naval power, is virtually non existent.

Present Capabilities—Maritime Air Forces

As was the case with the navy, the key to understanding the road to the future of the air force lies in the past. When Canadian naval forces were focused on the ASW escort role, air support was provided in the form of shore based ASW CP-140 Aurora patrol aircraft and shipboard ASW CH-124A/B Sea King helicopters. The primary armament for these aircraft was, and continues to be, the Mk-46 torpedo. As the fleet evolved to a force with a modern general purpose capability in the ASW, ASuW, and AAW environments, the supporting maritime air forces did not keep pace. To date, neither the Auroras nor the Sea Kings possess armament effective in the modern ASuW environment. The only ASuW capability possessed is the Aurora's 2.75 inch CRV-7 rocket capability. The Canadian developed CRV-7 is an unguided, non-precision weapon designed specifically for ground attack of large army formations. It is touted as the best 2.75 inch rocket in the world and as such it was recently selected by the British Army for their new Apache helicopter fleet.[2] However in the naval environment where long range, precision engagement is required because the defensive systems generally fitted to naval combatants limit the approach distance and number of sorties. Specifically, the 6000 meter (6 km) range of the CRV-7[3] make the platform using it vulnerable to even shoulder fired SAMs. For example the Shorts Starstreak SAM has a maximum effective range of 7000 meters (7

km).[4] Additionally, the characteristic of modern warfare to have the ability to minimize collateral damage when engaging targets further limit employability of unguided weapons. Therefore, the CRV-7 usefulness in the modern, high threat, ASuW environment is extremely limited.

Present Capabilities—Fighter Forces

Prior to the navy's development of a task group capable of operations in the modern ASW, ASuW, and AAW environments, there was no need to consider fighter operations in support of ships. The Canadian maritime areas of were not effectively challenged by anything other than aircraft and submarines. The aircraft concern was easily addressed by interceptors from Air Defence Command, and later Fighter Group, coordinated by North American Aerospace Defense Command (NORAD). Maritime Air Group focused upon the submarine threat. In the case of Canadian ships operating outside Canadian maritime areas when providing submarine escort screen to a NATO task or battle group; they would be protected by the ships and aircraft providing ASuW and AAW screen to the group. The "blue water" nature of the naval missions during the Cold War essentially necessitated the employment of aircraft carriers and limited the employment of shore based aircraft to all but the longest range, high endurance Maritime Patrol Aircraft (MPA).

As a result of the realities of the era, in the 1960's Canada's fighter forces were focused upon continental air defense of North America and contribution to forces protecting Europe. Canadian based CF-101 Voodoo aircraft were armed with the Hughes AIM-4D Falcon air-to-air missiles and the AIR-2A Genie unguided nuclear armed rocket**.**

Source: Christopher Shores, *History Of The Royal Canadian Air Force* (Toronto: Royce Publications, 1984), 113.

Figure 4. CF-101 Voodoo

Canadian NATO forces stationed in Europe consisted of an Air Division of fighter aircraft assigned to central Europe and an army brigade approaching division strength assigned to northern Europe. Employing the CF-104 Starfighter in the nuclear strike role, the Air Division consisted of ". . . 8 squadrons at an 18 aircraft strength . . ."[5] During defense down sizing which occurred in the later 1960's and early 1970's, Canada reduced and consolidated its forces stationed in Europe. The Air Division was reduced to an Air Group of three squadrons and assigned the role of providing close air support (CAS) to a smaller mechanized brigade group. The new Canadian Air Group and 4th Canadian Mechanized Brigade Group were co-located in central Europe. In this manner the reorganization produced forces that were as self-sufficient and synergistic as possible through a consolidated rather than fragmented Canadian contribution to collective security. Simultaneously, a Canadian based Brigade and two supporting CF-5 Freedom Fighter CAS squadrons were earmarked to reinforce NATO's northern flank in the event of hostilities. The CF-104s and CF-5s were armed with cannons and guns, CRV-7

rockets, dumb bombs, and AIM-9 SIDEWINDERS for self-defense. In short from a fighter perspective, the roles were essentially continental air defense in Canada using CF-101 Voodoos and CAS in Europe using CF-104s and CF-5s.

The 1980s witnessed further equipment acquisition and consolidation, but fighter roles remained air-to-air combat and CAS. The CF-101s, CF-104s, and CF-5s were replaced by the CF-18. Canadian fighter squadrons were equipped and trained to perform air-to-air combat in defense of Canada as-well-as air-to-air and CAS missions in support of the brigade in central Europe. Canada's commitment to NATO's northern flank was eliminated. As a result, the Air Group in central Europe was increased to Division status with the assignment of two fly-over Canadian based squadrons. The CF-18s were armed with AIM-7M SPARROW and AIM-9M SIDEWINDER missiles in the air-to-air role and cannons, CRV-7 rockets, and dumb bombs in the CAS role. As previously presented, during the Arabian Gulf Crisis, CF-18s were deployed to Qatar in order to provide a counter air capability against the threat of large numbers of Iraqi fighters. With the close of the Cold War in the early 1990s, Canadian Forces in Europe were withdrawn and tremendous down sizing took place. Among other initiatives, the 4th Canadian Mechanized Brigade Group was disbanded and half the CF-18s in the inventory were placed in storage. Essentially for thirty years spanning from the early 1960s to the 1990s, fighter operations were characterized by a focus upon air-to-air interceptor and fighter roles and CAS. With the CF-18s, very capable air-to-air armament was acquired, but CAS armament was unsophisticated, non-precision, unguided, and short ranged. This armament is not effective in the ASuW role.

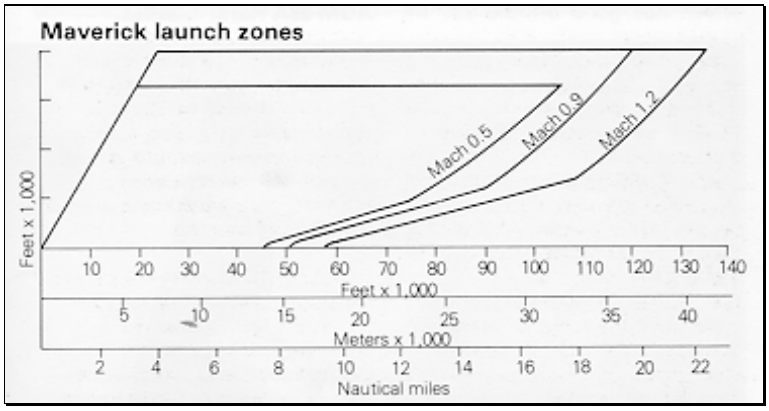
Source: Mike Spick, An Illustrated Guide To Modern Attack Aircraft (London: Prentice Hall Press, 1987), 29

Figure 5. CF-18 Firing CRV-7 Rockets

Future Expectations

In 1996 a number of AGM-65G MAVERICK air-to-surface missiles, PAVEWAY III 2000 pound laser guided general purpose bombs, and the Nighthawk B Forward Looking Infrared targeting and navigation pods were acquired.[6] These munitions are the first air-to-surface precision guided munitions (PGMs) acquired by the Canadian Forces. The laser guided bomb virtually has no standoff capability and MAVERICK's range is presented in Figure 6. These weapons were essentially developed for the CAS of ground troops and have been adapted to the more general application of precision surgical attack of "critical node" ground targets. In the past, weapons such as these were adapted by some nations for the ASuW role;[7] however, their very short range make their utility in this

application extremely limited and render the launch platform extremely vulnerable in today's naval environment.



Source: Mike Spick, An Illustrated Guide To Modern Attack Aircraft (London: Prentice Hall Press, 1987), 31

Figure 6. MAVERICK Launch Zones

Recall the ranges of area and point defense missiles employed by Canada's naval vessels which are representative of those employed in today's littoral environment. These weapons illustrate that even the point defense weapons characteristic of naval vessels can engage aircraft platforms employing MAVERICK. The primary usefulness of these weapons, particularly MAVERICK, in the ASuW role is in the case of a MPA or shipboard helicopter which inadvertently stumbles across an enemy vessel at extremely short range, for example a patrol boat hidden in a fjord or over flight of a vessel incorrectly classified a neutral "white shipping" where the ship's crew has shoulder fired SAMs. In cases such as these, a quick reaction, short range strike is required. However, these situations are very limited and almost exclusively pertain to vessels masked by the shoreline or vessels which are not combatants. In these examples MAVERICK has a valid role and in fact is the likely the weapon of choice. However, these situations are the exception, particularly during war. In the greater expanses which characterize the

majority of the littoral area, a longer range engagement capability is required. Although in exceptional circumstances MAVERICK is effective, given the nature of the modern naval environment; it should not be considered suitable as a primary ASuW weapon. Both the MAVERICK and the laser guided bombs must primarily be considered weapons for the CAS role or for use against other land based targets. As such, despite continuation of a good capability in AAW, ASW, and CAS; in the near term ASuW and standoff attack capabilities required in a littoral environment will still be lacking in the air force, Table 1 refers.

Table 1. Air Force Weapons

Warfare Area	Weapon	Effectiveness
AAW	AIM-7M SPARROW AIM-9M SIDEWINDER	Good Good
ASW	Mk-46 Torpedo	Good
CAS	AGM-65G MAVERICK Laser Guided Bombs CRV-7 Rockets Unguided Bombs	Good Good Good Poor - Good
ASuW	Same As CAS Weapons	Poor
Standoff Attack	Same As CAS Weapons	Poor

Although the defense policy specifies the requirement for naval, air, and army forces to be capable of operating together abroad; the focus will likely be on the naval and air forces. As occurred during the Arabian Gulf Conflict and as presented above, the propensity is to commit naval forces first. Supporting the naval force, if necessary, is the next logical step. In the post Cold War down sizing, the army has not benefited from the equipment modernization, acquisition, and modification initiatives to the same extent as the navy and air force. Further, recognition that the army contribution abroad will

principally be at the Battle Group level, i.e. smaller than Brigade size, indicates that a significant army force will not likely be committed to a foreign crisis. Therefore, it appears that the most likely combination of forces committed will be naval and air force, again as occurred during the Arabian Gulf Conflict. Thus, unlike in the past where fighters committed abroad were exclusively linked to support of the army; the primary link of the future will be with the navy. In support of this position, since the Arabian Gulf Conflict, the CF-18s have begun to exercise more closely with the navy, as demonstrated by Exercise RIMPAC '96. However, likely due to their armament limitations, the fighters were employed solely in an AAW role.[8] At present, the air force is not equipped or armed to fully support the navy in the complex littoral environment due to its lack of an effective ASuW capability. However, given the above, it is likely that it will not be long before this deficiency is addressed and in this manner Canada's navy will have influenced not only future air force roles but armament as well. In short, there is likely an emerging air force ASuW and standoff attack capability. Finally, despite the fact that the likely teaming of forces will be naval and air force; the air force is well positioned to support the army should this contribution need to be made.

Notes

[1]"Fighter Group," *Canada's Air Force*, 2 April 1996, n.p., on-line, Internet, 7 March 1997, available from http:www.achq.dnd.ca/aftoday/rolsmsns.htm

[2]Darren Web, "In The Market Place," *Canadian Defence Quarterly*, Vol. 25, No. 1 (Autumn 1996): 37-38

[3]Jane's Information Group, *Jane's Air Launched Weapons* (Surrey: Jane's Information Group Limited, June 1995), Issue 21

[4]Jane's Information Group, *Jane's Land-Based Air Defence, Ninth Edition 1996-97* (Surrey: Jane's Information Group Limited, 1996), 24-25

[5]Christopher Shores, *History Of The Royal Canadian Air Force* (Toronto: Royce Publications, 1984), 106.

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Notes

[6]"The New Environment," *Canada's Air Force*, 2 April 1996, n.p., on-line, Internet, 10 March 1997, available from http:www.achq.dnd.ca/ftgroup/newenvrt.htm

[7]Chris Allan, *The Royal Air Force* (Surrey: Ian Allan Ltd., 1988), 75

[8]LCdr Philip Anido, "Trenton—Vital Link To Pacific Ops!," *Roundel*, July 1996, n.p., on-line, Internet, 7 March 1997, available from http:www.achq.dnd.ca/roundel/jul96/rimpac.htm

Chapter 7

What Should Be Done?

The Canadian post Cold War defense climate, as in many countries, is extremely constrained financially. As such, any acquisition efforts undertaken must maximize the benefits across the sea, air, and land military capabilities spectrum and be affordable. As the HARPOON is currently in the Canadian Forces inventory, one option would be to make it available to the CP-140s and CF-18s supporting the navy. Unfortunately this option would essentially take scarce resources away from naval surface vessels in order to fit them to aircraft - a "rob Peter to pay Paul" analogy. Further, the CP-140s and CF-18s would need minor modifications to enable them to utilize these weapons which may not be made available to them. Additional HARPOONs could be purchased for air force use, but there may be a better approach. The following proposal is a consideration which benefits the navy, air force, and army at relatively little cost.

Pursue The Acquisition Of SLAM—ER

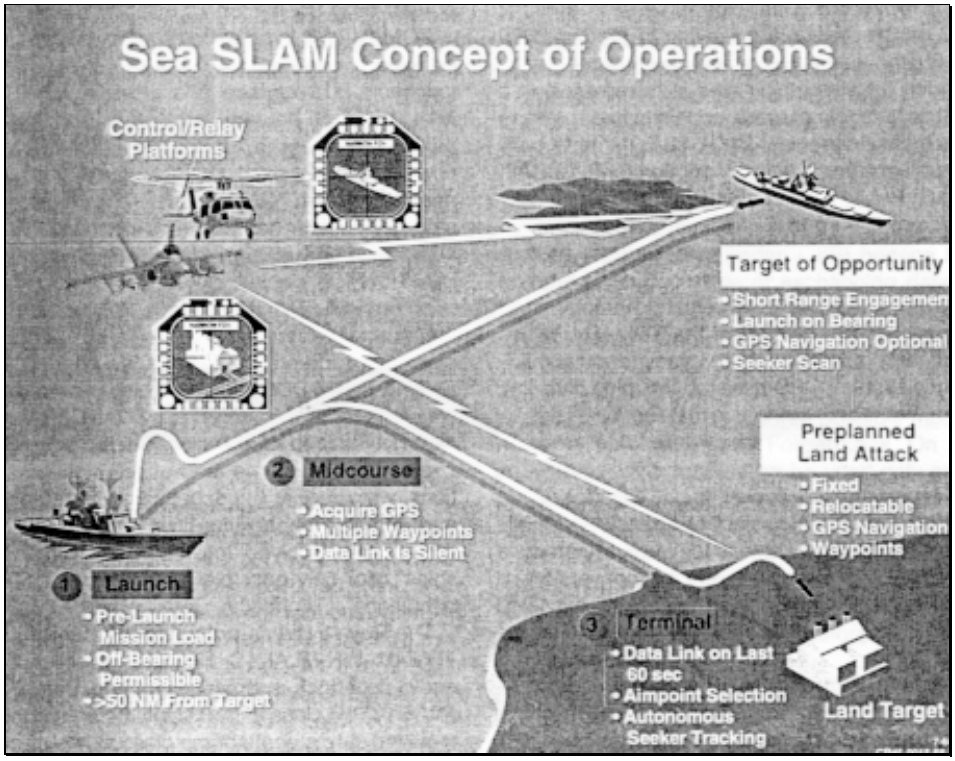
The USN Standoff Land Attack Missile is a HARPOON derivative that "was obtained in a low-risk, low-cost development effort by replacing the original radar seeker with the MAVERICK IR seeker, installing a WALLEYE data-link and adding a GPS-aided navigation system for cruise phase, the whole being accommodated into a slightly longer

airframe. As a result, practically all SLAM components are common either with the basic HARPOON or other proven, mature missile systems."[1] This commonality is beneficial because both HARPOON and MAVERICK are already in or about to enter the Canadian inventory. "SLAM was successfully used during the Gulf War. Thanks to the very precise guidance and bomb damage assessment offered by the IR sensor, one SLAM was able to destroy a target by entering it through a hole opened by the previous missile."[2] SLAM - ER is an upgrade package, currently under development, which will be used to retrofit existing SLAM missiles. The upgrade package will include folding wings, improved seeker window and warhead design. The result is a weapon with reduced radar cross section, improved range, larger flight envelope, greater jam resistance among other enhancements. SLAM - ER improves the missile's range to ". . . more than (185.2 km) 100 nm at higher altitudes…"[3] and thus offers a tremendous standoff capability and precision. It is designed to be launched from CP-140s, CF-18s, and HARPOON capable surface ships with minor modifications to these platforms.

Acquisition of this weapon will permit the air force to make over land surgical "attacks" at a standoff range which will minimize aircraft vulnerability. These strikes may be made as an independent air force contribution to a given campaign or in direct support of the army. The weapon may also be used over land in support of the navy by engaging enemy ships in port, port facilities, etc. As presented in Figure 7, there is also an over water application for which the air force could use this missile, but it must be considered a secondary ASuW weapon to be used in cases where vessels are hidden by the radar clutter near inshore areas or where a passive attack is desired. HARPOON is considered the ideal over water weapon.

The navy could also use SLAM—ER to project power ashore. Therefore making a number of these missiles available as a secondary weapon on naval ships, for example three out of the eight HARPOON canisters fitted with SLAM—ER, will permit the transfer of an equal number of HARPOONs to the air force.

Therefore, acquisition of SLAM - ER is ideal because it results in navy and air force platforms having access to both HARPOON and SLAM—ER. In this manner the more capable weapon, either HARPOON or SLAM—ER, may be utilized as the situation dictates. Minor modifications would be required to CP-140, CF-18, and shipboard systems.



Source: Massimo Annati and Ezio Bonsignor, "Punch From The Sea," *Military Technology*, Vol. XX (Issue 7 1996): 48

Figure 7. The Standoff Land Attack Missile

Pursue The Acquisition Of An Anti-Radiation Missile

An anti-radiation missile such as HARM or ALARM should be acquired to enhance the offensive capability of the air force's CF-18s and CP-140s. In the increasingly complex littoral environment, the ability to strike a target in a passive mode without providing a warning through active radar transmission is required. Although this capability is resident in the SLAM - ER; this missile is primarily intended for deliberate, well planned attack of targets where intelligence, Electronic Support Measures, etc. provide an indication of target location. In cases where an extremely quick reaction is required to an unexpected situation; the aircraft launched anti-radiation missile is more appropriate. This is precisely how the Royal Australian Air Force intends to use HARM in the maritime role on their updated P-3C Orion's which are similar to the CP-140. Additionally, these missiles are ideal for attacking high value targets over land which are well defended by SAM sites where quick reaction is required on the part of the attacking aircraft. As such, an anti-radiation missile is an ideal weapon to ensure the ability of Canadian Forces aircraft to quickly, effectively, and passively engage targets in the sophisticated littoral environment. This missile can be utilized to make an independent air force contribution to a campaign or be used in direct support of the army and navy.

Expand The Employment Of MAVERICK

In addition to CF-18s, the MAVERICKs acquired as a result of the 1996 initiative should also be employment on CP-140 for engagement of targets which appear unexpectedly at close range, such as in a fjord. MAVERICK is useful in these situations because it allows less sophisticated targets which may not be radiating, such as those

armed with Stinger SAMs, to be engaged. "A good example is the USN's plan to add the AGM-65F MAVERICK Missile to the P-3C Orion as part of the ASuW Improvement Program."[4] It may be that in littoral operations, the ideal weapons load for the CP-140 is Mk-46 torpedoes carried internally and four missiles. Depending on the environment the missiles could be a mixture of HARPOON, SLAM- ER, HARM, and MAVERICK as determined by the operational situation.

Source: Jack Owen, "ASUW Training Support," *Maritime Patrol Aviation*, Vol. 3/No 3 (September 1995): 33

Figure 8. USN P-3C Orion Armed With MAVERICK

Command And Control (C2) Enhancement

In addition to acquiring weapons and modifying weapons platforms, C2, Standard Operating Procedures, etc. must be established and exercised to ensure extremely close

and mutually supportive operations can be conducted by naval, air, and land forces. Specifically, aspects of shore based air support to naval ships in the ASuW role should be further developed.

Pursue An Enhance AAW Capability

With the acquisition of SLAM - ER and anti-radiation missiles, the previous air force and navy armament deficiencies would be resolved. Once these acquisition steps are taken, over the longer term an enhanced AAW capability should be pursued. Specifically, the AIM-7 SPARROW should be replaced by the AIM-120 AMRAAM. Thus, the lethality of a small number of fighter aircraft, say those flying a Combat Air Patrol at extended range in support of a naval Task Group, would be greatly enhanced through the "fire and forget" feature of the AMRAAM. As a result, a small number of aircraft, which is the likely number that one squadron could muster at one time to ensure a constant long range CAP were established, could much more rapidly engage multiple airborne targets compared to employment of the AIM-7. In this manner, enemy aircraft can be engaged at a greater distance by quick multiple target attacks. "One of the major restrictions on the use of the AIM-7 and any other semi-active radar homing missile is that the launch aircraft has to continue towards the target until the weapon reaches it."[5] Not only does this ". . . allow the enemy time to launch a short range missile before the AIM-7 arrives, hence both aircraft may be lost,"[6] but it prevents the engagement of additional targets while the AIM-7 is enroute. An initiative to purchase the AMRAAM would ensure the effectiveness of the CF-18 is retained in the AAW role where the trend is toward increasingly long range engagement. "A significant shift is occurring as medium range air-to-air missiles are being

built in larger numbers than short-range missiles…Air combat experience in the Gulf War suggests that medium-range missiles are finally achieving the beyond-visual range capabilities.…This trend is being further reinforced by the arrival of a new generation of active homing medium-range missiles, most notably the Hughes/Raytheon AIM-120 AMRAAM and Matra Mica.…"[7] Minor modifications would be required to the CF-18 to enable AMRAAM employment. Acquisition of this missile would also enhance the air force's ability to conduct continental air defense in support of NORAD with limited assets as-well-as better provide air superiority in support of the navy or army abroad.

Cost

The cost of missile acquisition is orders of magnitude less expensive than acquisition of new weapons platforms such as the $4-6 Billion cost of new submarines. For example, the cost of one AMRAAM was US$229,000 in 1994.[8] Although the cost for a SLAM-ER and an anti-radiation missile is not known exactly, even if one assumed a cost of $1 Million a missile, which is likely high; it can be seen that for a relatively modest investment a sufficient number of missiles could be purchased to ensure that the aircraft and ships committed to any crisis area would be well armed. The necessary modifications to the platforms are relatively minor. Therefore, even though the approximately $10 Billion annual defense budget is under tremendous pressure; it is likely that the acquisition of the missiles described herein, and embodiment of the modifications to aircraft and ships necessary to employ them, could be relatively easily accommodated.

Notes

[1]Massimo Annati and Ezio Bonsignor, "Punch From The Sea," *Military Technology*, Vol. XX (Issue 7 1996): 47

[2]Ibid.

[3]Stanley W. Kandebo, "Upgraded SLAM To Complement TSSAM," *Aviation Week & Space Technology*, (March 21, 1994): 53

[4]Jack Owen, "ASUW Training Support," *Maritime Patrol Aviation*, Vol 3/No 3 (September 1995): 33

[5]Michael Taylor, *Naval Air Power* (New York: Prentice Hall Press, 1986), 119

[6]Ibid.

[7]Steven Zaloga, "Missiles Ride Gulf War Wave," *Aviation Week & Space Technology*, (January 8, 1996): 129

[8]McGraw Hill, *Aviation Week & Space Technology*, (January 17, 1994): 17

Chapter 8

Conclusion

Traditionally Canada does not maintain a large military during times of peace, and the current national debt has resulted in even greater pressure to reduce defense spending. Notwithstanding their relatively small size, the Canadian Forces generally are very professional and highly trained; and Canada, as a member of the international community, is committed to sending forces abroad in response to a crisis in order to support international stability. These naval, air, and army forces are required to be capable of operating *together*, quite likely in an extremely challenging high threat littoral environment where the navy will likely be the first committed to a crisis. Air power can make a tremendous contribution in the littoral environment, and as such, the future roles of the air force are inexorably linked to the navy. Unfortunately, the air force, primarily due to history, does not possess the ability to fully operate effectively in this environment. It lacks an effective independent standoff attack capability and the ability to provide effective ASuW support to ships at sea. Further, the modern Canadian naval fleet does not have the weapons to conduct the emerging primary role for naval forces - power projection ashore. In order to maintain effective forces capable of being committed to modern, complex, high threat combat environments; the present deficiencies of the air force and navy must be addressed. Considering the current fiscal restraints, one relatively

inexpensive solution is the purchase of SLAM-ER, anti-radiation, and AMRAAM missiles. Along with the purchase of these weapons, the increased distribution of HARPOON and MAVERICK, the necessary minor modifications to aircraft and ship platforms, and development of enhanced C2 should be pursued. Through this modest acquisition, modification, and training effort; the air force will have the ability to effectively contribute independently to a campaign or to support the navy or army in the modern, high threat environment. Additionally, the modern Canadian navy will establish a capability to project power ashore. By undertaking these or similar initiatives to those specified in this research paper, not only will the Canadian Forces establish an effective capability in the likely environment of future employment, but it can be achieved in a relatively inexpensive and affordable manner during these fiscally constrained days of peace.

Appendix A

Large Combatants Of The Canadian Navy

The following is an excerpt from *Jane's Fighting Ships 1996-97*:[1]

SUBMARINES

Notes: (1) The April 1992 Defence Policy Announcement stated that in a project continuing past the 15 year planning period, the navy will replace its current submarine fleet with up to six modern conventional submarines in order to provide an underwater capability in both the Atlantic and the Pacific. A request for proposals is expected in 1996 unless it is overtaken by an off-the-shelf purchase of British Upholder class submarines. (2) Ex-UK *Olympus* was purchased in August 1989 and is used for alongside training in Halifax. *Osiris* acquired in 1992 and cannibalised for spares.

3 OBERON CLASS (PATROL SUBMARINES) (SSK)

Name	*No*	*Builders*	*Laid down*	*Launched*	*Commissioned*
OJIBWA (ex-*Onyx*)	72	HM Dockyard, Chatham	27 Sep 1962	29 Feb 1964	23 Sep 1965
ONONDAGA	73	HM Dockyard, Chatham	18 June 1964	25 Sep 1965	22 June 1967
OKANAGAN	74	HM Dockyard, Chatham	25 Mar 1965	17 Sep 1966	22 June 1968

Displacement, tons: 2,030 surfaced; 2,410 dived
Dimensions, feet (metres): 295.2 × 26.5 × 18 *(90 × 8.1 × 5.5)*
Main machinery: Diesel-electric; 2 ASR 16 VVS-ASR1 diesels; 3,680 hp *(2.74 MW)*; 2 AEI motors; 6,000 hp *(4.48 MW)*; 2 shafts
Speed, knots: 12 surfaced; 17 dived; 10 snorting
Range, miles: 9,000 surfaced at 12 kts
Complement: 65 (7 officers)

Torpedoes: 6—21 in *(533 mm)* bow tubes. 20 Gould Mk 48 Mod 4; dual purpose; active/passive homing to 50 km *(27 nm)*/38 km *(21 nm)* at 40/55 kts; warhead 267 kg.
Countermeasures: ESM: Sperry Guardian Star; radar warning.
Weapons control: Loral Librascope TFCS with Sperry UYK 20 computer.
Radars: Navigation: Kelvin Hughes Type 1006 or Furuno 1831 *(Onondaga)*; I-band.
Sonars: Plessey Triton Type 2051; hull-mounted; passive/active search and attack; medium frequency.
BAC Type 2007 AC; flank array; passive search; long range; low frequency.
BQG 501 Sperry Micropuffs; passive ranging.
Hermes Electronics/MUSL towed array; passive low frequency.

Programmes: In 1962 the Ministry of National Defence announced that Canada was to buy three Oberon class submarines in the UK. The first of these patrol submarines was obtained by the Canadian Government from the Royal Navy construction programme. She was laid down as *Onyx* but launched as *Ojibwa*. The other two were Canadian orders. There were some design changes to meet specific new needs including installation of RCN communications equipment and increase of air conditioning capacity to meet the wide extremes of climate encountered in Canadian operating areas. All are to have their service lives extended until the end of the century.
Modernisation: All underwent SOUP (Submarine Operational Update Project) with more modern sonar and fire control equipment fitted. *Ojibwa* 1980-82, *Onondaga* 1982-84 and *Okanagan* 1984-86. Starting in 1987 weapon launching and fire control systems were upgraded to take the US Mk 48 torpedo which replaced the Mk 37. Plessey Triton Type 2051 sonar purchased in 1989. All three submarines fitted with towed array sonars starting with *Okanagan* in 1993. TFCS is being updated at the same time.

ONONDAGA *3/1994, van Ginderen Collection*

Structure: Diving depth, 200 m *(656 ft)*. Stern tubes have been blanked off. Pilkington Optronics CK 24 search, and CH 74 attack, periscopes.

UPDATED

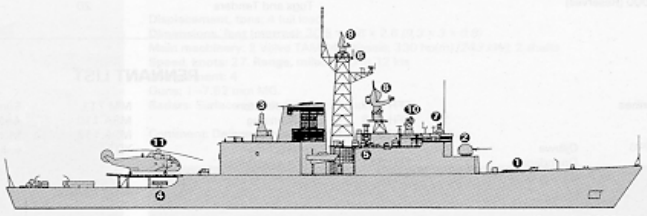
DESTROYERS

4 IROQUOIS CLASS (DDG)

Name	No	Builders	Laid down	Launched	Commissioned
IROQUOIS	280	Marine Industries Ltd, Sorel	15 Jan 1969	28 Nov 1970	29 July 1972
HURON	281	Marine Industries Ltd, Sorel	15 Jan 1969	3 Apr 1971	16 Dec 1972
ATHABASKAN	282	Davie Shipbuilding, Lauzon	1 June 1969	27 Nov 1970	30 Sep 1972
ALGONQUIN	283	Davie Shipbuilding, Lauzon	1 Sep 1969	23 Apr 1971	3 Nov 1973

Displacement, tons: 5,100 full load
Dimensions, feet (metres): 398 wl; 426 oa × 50 × 15.5 keel/21.5 screws *(121.4; 129.8 × 15.2 × 4.7/6.6)*
Main machinery: COGOG; 2 Pratt & Whitney FT4A2 gas-turbines; 50,000 hp *(37 MW)*; 2 GM Allison 570-KF gas-turbines; 12,700 hp *(9.5 MW)* sustained; 2 shafts; cp props
Speed, knots: 27. **Range, miles:** 4,500 at 15 kts (cruise turbines)
Complement: 292 (26 officers) plus aircrew 30 (9 officers)

Missiles: SAM: 1 Martin Marietta Mk 41 VLS ❶ for 29 GDC Standard SM-2MR Block III; command/inertial guidance; semi-active radar homing to 73 km *(40 nm)* at Mach 2.
Guns: 1 OTO Melara 3 in *(76 mm)*/62 Super Rapid ❷; 85° elevation; 120 rds/min to 16 km *(8.7 nm)*; weight of shell 6 kg.
1 GE/GDC 20 mm/76 6-barrelled Vulcan Phalanx Mk 15 ❸; 3,000 rds/min combined to 1.5 km.
Torpedoes: 6—324 mm Mk 32 (2 triple) tubes ❹. Honeywell Mk 46 Mod 5; anti-submarine; active/passive homing to 11 km *(5.9 nm)* at 40 kts; warhead 44 kg.
Countermeasures: Decoys: 4 Plessey Shield Mk 2 6-tubed trainable launchers ❺. P 8 chaff or P 6 IR flares.
SLQ-25 Nixie; torpedo decoy.
ESM: MEL SLQ-501 Canews ❻; radar warning. SRD 503; intercept.
ECM: ULQ-6; jammer.
Combat data systems: SHINPADS, automated data handling with UYQ-504 and UYK-507 processors. Links 11 and 14. WSC-IV and SSR-1 SATCOM. JOTS II.
Weapons control: Signaal LIROD 8 ❼ optronic director. UYS-503(V) sonobuoy processor.
Radars: Air search: Signaal SPQ-502 (LW08) ❽; D-band.
Surface search: Signaal SPQ-501 (DA08) ❾; E/F-band.
Fire control: Two Signaal SPG-501 (STIR 1.8) ❿; I/J-band.
Navigation: Two Raytheon Pathfinder; I-band.
Koden MD 373 (*Iroquois* only, on hangar roof); I-band.
Tacan: URN 26.



ALGONQUIN *(Scale 1 : 1,200), Ian Sturton*

Sonars: Westinghouse SQS-505 (being upgraded to 510); combined VDS and hull-mounted; active search and attack. Two sets.

Helicopters: 2 CH-124A Sea King ASW ⓫.

Modernisation: A contract for the Tribal Class Update and Modernisation Project (TRUMP) was awarded to Litton Systems Canada Limited in June 1986. The new equipment reflects the changing role of the ship and replaced systems that did not meet the air defence requirement. *Algonquin* started modernisation in November 1987 at Mil Davie, Quebec, and completed October 1991, followed by *Iroquois*, started November 1988, and completed May 1992. *Athabaskan* entered the yard in September 1991 and completed in August 1994; *Huron* started in June 1992 and completed 17 January 1995. SQS-505 sonar being upgraded to 510 from 1994.
Structure: These ships are also fitted with a landing deck equipped with double hauldown and Beartrap, pre-wetting system to counter NBC conditions, enclosed citadel, and bridge control of machinery. The flume type anti-roll tanks have been replaced during modernisation with a water displaced fuel system. Design weight limit has been reached.
Operational: Helicopters can carry 12.7 mm MGs and ESM/FLIR instead of ASW gear. *Algonquin* and *Huron* are based in the Pacific.

UPDATED

FRIGATES

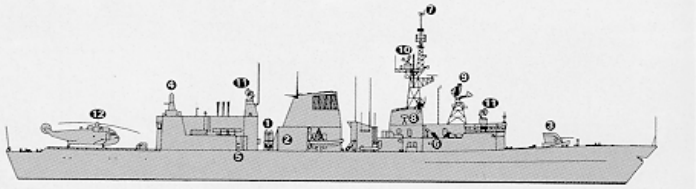
Note: *Yukon* (263) is used as an alongside training ship at Esquimalt.

11 + 1 HALIFAX CLASS (FFH/FFG)

Name	*No*	*Builders*	*Laid down*	*Launched*	*Completed*	*Commissioned*
HALIFAX	330	Saint John SB Ltd, New Brunswick	19 Mar 1987	30 Apr 1988	28 June 1991	29 June 1992
VANCOUVER	331	Saint John SB Ltd, New Brunswick	19 May 1988	8 July 1989	11 Sep 1992	23 Aug 1993
VILLE DE QUÉBEC	332	Marine Industries Ltd, Sorel	17 Jan 1989	16 May 1991	23 Sep 1993	14 July 1994
TORONTO	333	Saint John SB Ltd, New Brunswick	24 Apr 1989	18 Dec 1990	23 Dec 1992	29 July 1993
REGINA	334	Marine Industries Ltd, Sorel	6 Oct 1989	25 Oct 1991	2 Mar 1994	30 Sep 1994
CALGARY	335	Marine Industries Ltd, Sorel	15 June 1991	28 Aug 1992	2 Sep 1994	12 May 1995
MONTREAL	336	Saint John SB Ltd, New Brunswick	8 Feb 1991	28 Feb 1992	27 July 1993	21 July 1994
FREDERICTON	337	Saint John SB Ltd, New Brunswick	25 Apr 1992	13 Mar 1993	27 Feb 1994	10 Sep 1994
WINNIPEG	338	Saint John SB Ltd, New Brunswick	19 Mar 1993	5 Dec 1993	30 Sep 1994	23 June 1995
CHARLOTTETOWN	339	Saint John SB Ltd, New Brunswick	5 Dec 1993	10 July 1994	28 Apr 1995	9 Sep 1995
ST JOHN'S	340	Saint John SB Ltd, New Brunswick	24 Aug 1994	12 Feb 1995	12 Dec 1995	24 June 1996
OTTAWA	341	Saint John SB Ltd, New Brunswick	29 Apr 1995	22 Nov 1995	30 June 1996	Jan 1997

Displacement, tons: 4,770 full load
Dimensions, feet (metres): 441.9 oa; 408.5 pp × 53.8 × 16.4; 23.3 (screws) *(134.7; 124.5 × 16.4 × 5; 7.1)*
Main machinery: CODOG; 2 GE LM 2500 gas-turbines; 47,494 hp *(35.43 MW)* sustained
1 SEMT-Pielstick 20 PA6 V 280 diesel; 8,800 hp(m) *(6.48 MW)* sustained; 2 shafts; cp props
Speed, knots: 29
Range, miles: 9,500 at 13 kts (diesel); 3,930 at 18 kts (gas)
Complement: 198 (17 officers) plus 17 (8 officers) aircrew

Missiles: SSM: 8 McDonnell Douglas Harpoon Block 1C (2 quad) launchers ❶; active radar homing to 130 km *(70 nm)* at 0.9 Mach; warhead 227 kg.
SAM: 2 Raytheon Sea Sparrow Mk 48 octuple vertical launchers ❷; semi-active radar homing to 14.6 km *(8 nm)* at 2.5 Mach; warhead 39 kg; 28 missiles (16 normally carried).
Guns: 1 Bofors 57 mm/70 Mk 2 ❸; 77° elevation; 220 rds/min to 17 km *(9 nm)*; weight of shell 2.4 kg.
1 GE/GDC 20 mm Vulcan Phalanx Mk 15 Mod 1 ❹; anti-missile; 3,000 rds/min (6 barrels combined) to 1.5 km.
8—12.7 mm MGs.
Torpedoes: 4—324 mm Mk 32 Mod 9 (2 twin) tubes ❺. 24 Honeywell Mk 46 Mod 5; anti-submarine; active/passive homing to 11 km *(5.9 nm)* at 40 kts; warhead 44 kg.
Countermeasures: Decoys: 4 Plessey Shield Mk 2 decoy launchers ❻; triple mountings; fires P8 chaff and P6 IR flares in distraction, decoy or centroid modes.
Nixie SLQ-25; towed acoustic decoy.
ESM: MEL/Lockheed Canews SLQ-501 ❼; radar intercept; (0.5-18 GHz). SRD 502; intercept.
ECM: MEL/Lockheed Ramses SLQ-503 ❽; jammer.
Combat data systems: UYC-501 SHINPADS action data automation with UYQ-504 and UYK-505 or 507 (336-341) processors. Links 11 and 14.
Weapons control: SWG-1(V) for Harpoon. CDC UYS-503(V); sonobuoy processing system.
Radars: Air search: Raytheon SPS-49(V)5 ❾; C/D-band; range 457 km *(250 nm)*.
Air/surface search: Ericsson Sea Giraffe HC 150 ❿; G/H-band; range 100 km *(55 nm)* against missiles in clear conditions.
Fire control: Two Signaal SPG-503 (STIR 1.8) ⓫; K/I-band; range 140 km *(76 nm)* for 1 m² target.
Navigation: Sperry Mk 340 being replaced by Kelvin Hughes 1007; I-band.
Tacan: URN 25. IFF Mk XII.
Sonars: Westinghouse SQS-505(V)6 (being upgraded to SQS-510); hull-mounted; active search and attack; medium frequency.



HALIFAX *(Scale 1 : 1,200), Ian Sturton*

VILLE DE QUÉBEC *3/1995*, M Declerck*

CDC SQR-501 CANTASS towed array (uses part of Martin Marietta SQR-19 TACTASS).

Helicopters: 1 CH-124A ASW or 1 CH-124B Heltas Sea King ⓬.

Programmes: On 29 June 1983 Saint John Shipbuilding Ltd won the competition for the first six of a new class of patrol frigates. Combat system design and integration was subcontracted to Loral Canada (formerly Paramax, a subsidiary of Unisys). Three ships were subcontracted to Marine Industries Ltd in Lauzon and Sorel. On 18 December 1987 six additional ships of the same design were ordered from Saint John SB Ltd with delivery by 1997.

Structure: Plans to lengthen some of the class to increase SAM capacity and improve accommodation have been shelved which means there is limited reserve for mid-life modernisation. Much effort has gone into stealth technology. Gas turbine engines are raft mounted. Dresball IR suppression is fitted. Indal RAST helicopter handling system.
Operational: Problems on first of class trials included higher than designed radiated noise levels which are reported as speed associated. These have been rectified and the ships are stable and quiet in all sea conditions. *Vancouver, Regina, Calgary* and *Winnipeg* are Pacific based. *Ottawa* is earmarked for the Pacific on completion.

UPDATED

AUXILIARIES

2 IMPROVED PROVIDER CLASS (AOR)

Name	No	Builders	Laid down	Launched	Commissioned
PROTECTEUR	AOR 509	St John Dry Dock Co, NB	17 Oct 1967	18 July 1968	30 Aug 1969
PRESERVER	AOR 510	St John Dry Dock Co, NB	17 Oct 1967	29 May 1969	30 July 1970

Displacement, tons: 8,380 light; 24,700 full load
Dimensions, feet (metres): 564 × 76 × 33.3 *(171.9 × 23.2 × 10.1)*
Main machinery: 2 boilers; 1 GE Canada turbine; 21,000 hp *(15.7 MW)*; 1 shaft; bow thruster
Speed, knots: 21
Range, miles: 4,100 at 20 kts; 7,500 at 11.5 kts
Complement: 365 (27 officers) including 45 aircrew
Cargo capacity: 14,590 tons fuel; 400 tons aviation fuel; 1,048 tons dry cargo; 1,250 tons ammunition; 2 cranes (15 ton lift)
Guns: 2 FMC 3 in *(76 mm)*/50 Mk 33 (twin). Mounted in the bow and under local control it was removed from both ships in 1983 but replaced in *Protecteur* in 1990 for Gulf deployment. 2 GE/GDC 20 mm/76 6-barrelled Vulcan Phalanx Mk 15. 6—12.7 mm MGs.
Countermeasures: Decoys: 4 Loral Hycor SRBOC chaff launchers.
ESM: Racal Kestrel SLQ-504; radar warning.
Combat data systems: EDO Link 11; SATCOM WSC-3(V).
Radars: Surface search: Norden SPS-502 with Mk XII IFF.
Navigation: Racal Decca 1630 and 1629; I-band.
Tacan: URN 20.
Sonars: Westinghouse SQS-505; hull-mounted; active search; can be fitted.
Helicopters: 3 CH-124A ASW or CH-124B Heltas Sea King.

Comment: An improved design based on the prototype *Provider*. Four replenishment positions. Both have been used as Flagships and troop carriers. They can carry anti-submarine helicopters, military vehicles and bulk equipment for sealift purposes; also four LCVPs. For the Gulf deployment in 1991, the 76 mm gun was remounted, two Vulcan Phalanx and two Bofors 40/60 guns were fitted, 4 Plessey Shield chaff launchers and ESM equipment were provided for *Protecteur*. Additionally, all helicopters carried 12.7 mm MGs and ESM/FLIR equipment instead of ASW gear. Bofors and 76 mm gun later removed from *Protecteur*. Remaining equipment retained and also installed in *Preserver* during her 1992 refit. Weapon system positions in *Protecteur* changed during her 1993/94 refit. *Protecteur* transferred to the Pacific Fleet November 1992.

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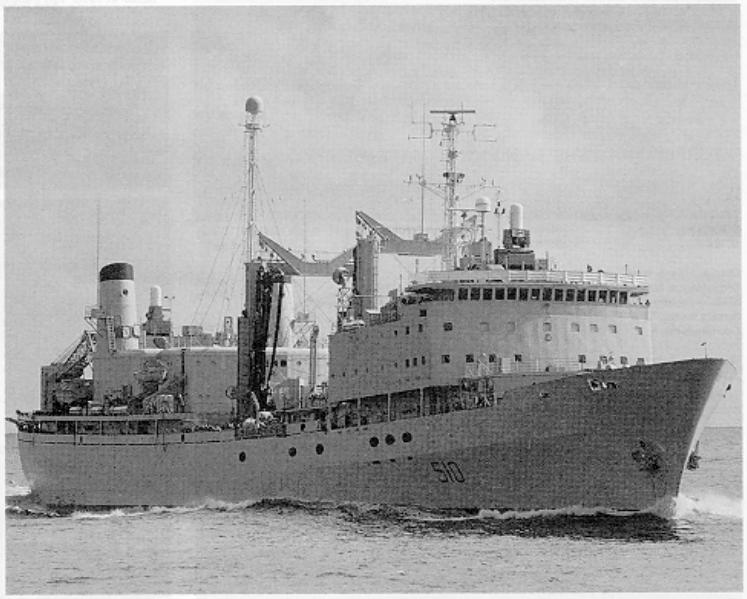

PRESERVER *10/1993, C E Castle*

1 PROVIDER CLASS (AOR)

Name	No	Builders	Laid down	Launched	Commissioned
PROVIDER	AOR 508	Davie Shipbuilding, Lauzon	1 May 1961	5 July 1962	28 Sep 1963

Displacement, tons: 7,300 light; 22,000 full load
Dimensions, feet (metres): 555 × 76 × 35.6 *(169.2 × 23.2 × 10.7)*
Main machinery: 2 Combustion Engineering boilers; 1 Westinghouse steam turbine; 21,000 hp *(15.7 MW)*; 1 shaft
Speed, knots: 20. **Range, miles:** 4,300 at 20 kts
Complement: 288 (22 officers)
Cargo capacity: 17,340 tons fuel; 665 tons aviation fuel; 250 tons dry cargo
Countermeasures: Decoys: 2 Corvus chaff launchers.
ESM: Racal Kestrel SLQ-504; radar warning.
Combat data systems: SATCOM WSC-3(V).
Radars: Navigation: Racal Decca 65170; I-band.
Sonars: SQS-503; hull-mounted; active search; medium frequency.
Helicopters: 3 CH-124A Sea King ASW.

Comment: The flight deck can receive the largest and heaviest helicopters. A total of 20 electrohydraulic winches is fitted on deck for ship-to-ship movements of cargo and supplies, as well as shore-to-ship requirements when alongside. Based in the Pacific Fleet. Can be fitted with Bofors and Vulcan Phalanx guns, chaff and ESM if sent on operational deployments. Retained for contingencies with a custodial crew and reactivated whenever one of the Improved Provider class is in refit.

UPDATED

PROVIDER *10/1993, Giorgio Arra*

Notes

[1]Jane's Information Group, *Jane's Fighting Ships 1996-97* (Surrey: Jane's Information Group, 1996), 86, 88, 93

Glossary

AAW	Anti-Air Warfare
ASW	Anti-Submarine Warfare
ASuW	Anti-Surface Warfare
AWACS	Airborne Early Warning And Control System
CAS	Close Air Support
CEC	Cooperative Engagement Capability
CTG	Canadian Task Group
GIUK	Greenland - Iceland - United Kingdom
GPS	Global Positioning System
IR	Infrared
km	Kilometer
MIL	MIL System Engineering Inc.
MPA	Maritime Patrol Aircraft
nm	Nautical Mile
NORAD	North American Aerospace Defense Command
SAM	Surface-to-Air Missile
TASMO	Tactical Air Support To Maritime Operations
USN	United States Navy

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